

SWAC C&D Subcommittee Meeting

MassDEP Bureau of Air & Waste

March 21, 2017: 10:00 AM - 12:00 PM

One Winter Street, Boston



Agenda

- Welcome/Introductions
- C&D Materials BMP Guidance (RecyclingWorks)
- 2016 C&D Debris Market Study (DSM)
- CY2015 C&D Facility Annual Report Data Summary
- Announcements/Open Discussion
- Closing/Next Steps

Emily Fabel, Center for EcoTechnology/RecyclingWorks in Massachusetts

C&D MATERIALS BEST MANAGEMENT PRACTICE GUIDANCE



RecyclingWorks C&D BMPs



Construction & Demolition Materials Best Management Practices

MassDEP C&D Subcommittee Meeting – March 21, 2017





RecyclingWorks in Massachusetts



- Free Assistance for businesses and institutions
 - Comply with MassDEP waste bans
 - Maximize waste diversion
 - Save money
 - Improve customer/employee satisfaction
- Funded by MassDEP, delivered under contract by the Center for EcoTechnology

The screenshot shows the RecyclingWorks Massachusetts website. At the top, there is a green header bar with the email 'info@recyclingworksma.com' and a phone icon with the text 'CALL OUR HOTLINE: (888) 254-5525'. Below the header is a navigation menu with links: ABOUT US, RECYCLE, PROGRAMS, FOOD WASTE, REUSE, and BLOG/EVENTS. The main content area has a background image of a recycling center with signs for 'COMPOST' and 'RECYCLE'. The title 'Recycling Assistance for Businesses & Institutions' is prominently displayed. Below the title is a search form with three dropdown menus: 'Pick Up/Drop Off?', 'Location', and 'Choose a Material', followed by a green 'SEARCH' button. Below the search form is a text input field with the placeholder 'Type in a material or the name of a business, e.g. food waste; Bob's Trucking;'. At the bottom of the main content area, there are two green buttons: 'LIST YOUR BUSINESS' and 'MORE INFO ABOUT RECYCLINGWORKS'. A paragraph of text describes the program: 'RecyclingWorks in Massachusetts is a recycling assistance program that helps businesses and institutions maximize recycling, reuse, and food waste diversion opportunities.' At the very bottom, there is a green bar with the text 'GET HELP FROM A RECYCLINGWORKS RECYCLING EXPERT' and a dark brown button with the text 'Call our hotline or email us a question. Click here for more information'.



RecyclingWorks in MA Services



- Online Resources
- Email and Phone Hotline
- Technical Assistance
- Events and Workshops





BMP Stakeholder Process



- Similar approach to
 - 2013 food waste collection BMP
 - 2015 food donation BMP
- Engage stakeholders – Contractors, Haulers, C&D Processors, Architects, Reuse Outlets, Building Inspectors
- Objective is to increase reuse and recycling of C&D materials

The screenshot shows the RecyclingWorks Massachusetts website. The header includes the email 'info@recyclingworksma.com' and a hotline number '(888) 254-5525'. The navigation bar lists 'ABOUT US', 'RECYCLE', 'PROGRAMS', 'FOOD WASTE', 'REUSE', and 'BLOG/EVENTS'. The main heading is 'FOOD DONATION GUIDANCE'. The content area includes an introduction to the program, a section on the EPA's Food Recovery Hierarchy (a pyramid diagram with levels: Source Reduction, Food Hungry People, Food Animals, Composting, and Landfills), and a list of four major steps for a successful food donation program. A flowchart at the bottom shows the process: 'Businesses and institutions donate surplus food' to 'Food banks and food rescue orgs', which then 'distribute surplus food to agencies', which 'serve meals made from surplus food items to those in need', and finally 'Food insecure individuals receive nutritious, good quality food'. The right sidebar features a 'Find A Recycler' form, 'Upcoming Events' (including EBCNE Annual C&D Summit and MassDEP SWAC Meeting), and a 'We Are Here To Help' section.



C&D BMP Development



- **Spring – Fall 2016:** 13 stakeholder meetings, 175 participants



- **Winter 2016/2017:** Draft BMPs and collect comments
- **Spring 2017:** Finalize and post BMPs



C&D BMP Draft Outline



- Regulatory Requirements
- Waste Management Plans
- Deconstruction & Demolition
- Materials Reuse
- Recycling
- Resources





Regulatory Requirements – Waste Bans



Massachusetts Waste Bans

- Asphalt pavement, brick & concrete
- Ferrous & non-ferrous metal
- Treated & untreated wood (banned from landfills only)
- Clean gypsum wallboard
- Recyclable paper, cardboard & paperboard



fact sheet

Your Business and the Waste Bans: What You Need to Know

What are waste bans?

"Waste bans" are restrictions on the disposal, transfer for disposal and contracting for disposal of certain hazardous items and recyclable materials at solid waste facilities in Massachusetts.

The waste bans are designed to:

- Conserve capacity at existing disposal facilities.
- Minimize the need for new facility construction.
- Provide recycling markets with large volumes of material on a consistent basis.
- Keep certain toxic substances or materials from adversely affecting our environment when landfilled or combusted.
- Promote business and residential recycling efforts.

What do I need to do? Remove & Recycle!

Business managers should remove and recycle any banned materials they generate or run the risk that waste loads will be rejected at a disposal site, charged an additional handling fee or face potential enforcement penalties. Recycling at businesses can be easier and more economical than recycling at home, because the materials are generated in larger quantities and are easier to keep separate from the rest of the trash. Recycling prevents unnecessary disposal of usable raw materials, saves energy and reduces air and water pollution. Recycling also reduces disposal costs and can save businesses money by diverting materials from the trash dumpster to the recycling bin.

Your waste hauler may be able to help you establish a recycling program. Also, the Massachusetts Materials Trader has an extensive list of companies that collect or process recyclable materials.

What is banned?

Asphalt Pavement, Brick, and Concrete: asphalt pavement, brick and concrete from construction and demolition of buildings, roads, bridges, and similar sources.

Batteries: Lead-acid batteries used in motor vehicles or stationary applications.

Cathode Ray Tubes: Any intact, broken or processed glass tube used to provide the visual display in televisions, computer monitors and certain scientific instruments.

Clean Gypsum Wallboard: A panel (known as drywall) with a gypsum core and faced with a heavy paper or other material on both sides that is not contaminated with paint, wallpaper, joint compound, adhesives, nails, or other substances after manufacture.

Glass Containers: Glass bottles and jars. The ban does not cover light bulbs, Pyrex cookware, plate glass, drinking glasses, windows, windshields and ceramics.

Leaves & Yard Waste: Leaves, grass clippings, weeds, garden materials, shrub trimmings, and brush one-inch or less in diameter (excluding diseased plants).



Regulatory Requirements – Hazardous Materials



- Lead
- Asbestos
- Mercury
- Mass Dept of Labor Standards and MassDEP requirements
- EPA safety documents

Before You Tear it Down, Get the Mercury Out

Recommended Management Practices for Pre-Demolition Removal of Mercury-Containing Devices from Residential Buildings



Mercury can be found in various devices in residential buildings. When a mercury-containing product breaks and the mercury is spilled, the exposed mercury can evaporate and become an invisible, odorless toxic vapor. To prevent mercury releases, these products should be used and stored safely, and managed properly at the end of their useful lives. This fact sheet specifically addresses pre-demolition removal of mercury-containing gas pressure regulators, mercury-containing boiler heating systems, and thermostats. For information on proper removal and management of other mercury-containing products in homes, go to www.epa.gov/osw/hazard/tsd/mercury/con-prod.htm.

Mercury-Containing Gas Pressure Regulators

Issue: Some homes that were built prior to 1968 have a mercury-containing gas pressure regulator adjacent to the gas meter. Most of these devices were manufactured and installed in the 1940s and 1950s, but a few were manufactured and installed in some areas as late as 1967. These devices contain approximately two teaspoons of mercury. Mercury spills have sometimes occurred during improper removal of these devices, causing a potentially significant health risk and resulting in costly cleanups.

Recommended Management: Mercury-containing gas pressure regulators should be removed only by qualified gas company personnel. Local government entities planning to demolish residential buildings (or anyone planning to demolish any building) having gas pressure regulators or other gas equipment should inform the local gas company of their proposed demolition



A gas pressure regulator, adjacent to a gas meter, with the location of the mercury cup identified.



World War II-era mercury-containing gas pressure regulator. (Photo courtesy of the American Gas Association.)

schedule at least two weeks in advance of demolition. This notice will enable the gas company to ensure that gas service is turned off, protect underground natural gas pipes and infrastructure from damage, prevent gas leaks, and coordinate the proper removal and disposal of any mercury-containing gas pressure regulators prior to demolition.

REMINDER: Call 811 before you dig to identify the location of gas lines!



Waste Management Plans



- Require waste diversion in bid specifications
 - Set diversion goals
 - Identify materials to target
 - Require contractor to develop a Waste Management Plan
- Waste Management Plan
 - List materials streams and projected quantities
 - Identify outlets/haulers for each stream
- Links to:
 - sample Waste Management Plan
 - sample Bid Specifications for C&D Waste

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

PART I - GENERAL

1.1 Related Sections (edit as appropriate for consistency)

- A. Section 01031 - Waste Management / Recycling Alternates
- B. Section 01060 - Regulatory Requirements
- C. Section 01094 - Definitions
- D. Section 01300 - Submittals
- E. Section 01600 - Materials and Equipment

1.2 Description of Work

- A. This section describes the requirements for the Contractor and all subcontractors to minimize construction waste and debris and to reuse, salvage, and recycle to the greatest extent feasible.
- B. This section includes a statement of [INSTITUTION]'s Waste Management Goals, requirements for the development of a draft and final Waste Management Plan, a reference to resources to assist in recycling, and steps for Management Plan Implementation.
- C. This section specifies certain wastes that are required to be recycled.
- D. This section specifies obligations for Reporting to the [INSTITUTION] weights of materials recycled and materials not recycled or reused throughout the project.

1.3 Intent and Waste Management Goals

- A. [INSTITUTION]'s waste management goals include increased recycling and conservation of materials. Construction and Demolition Wastes have been identified as a particular target for reuse and recycling, for several reasons:
 - C&D debris typically represents a large volume of material;
 - Many of the waste streams generated during building demolition and construction projects are highly recyclable at reasonable prices;
 - Massachusetts has banned landfill disposal of some C&D debris beginning in 2003, and expects to ban other C&D debris in subsequent years.
- B. [INSTITUTION] has determined that reducing, to the maximum extent practicable, the amount of waste disposed of in this project is a high priority. The Contractor and subcontractors shall take steps to generate the least amount of waste possible by minimizing waste due to error, poor planning, breakage, mishandling, contamination, or other factors.



Demolition and Deconstruction



- Pre-demolition cleanouts
- Demolition
- Deconstruction
 - Soft strip or full deconstruction
 - Can be cost-effective when materials are donated or sold for reuse





Material Reuse – Reuse Outlets



- Non-profit reuse stores in MA
 - Boston Building Resources
 - EcoBuilding Bargains (Springfield)
 - Habitat Humanity ReStores (10 across state)
- Focus on residential materials
- Offer free/inexpensive pick-ups
- Tax deduction for donation





Material Reuse – Other Outlets



- Informal reuse options
 - On-site or in future project
 - Networking sites (eg, Craigslist)
 - Swap shops and free sheds
- Other reuse outlets
 - Architectural salvage stores
 - Wood salvage businesses
 - Material brokers
 - Used furniture stores





Recycling – C&D Processors



- Ask hauler where their materials are delivered
- C&D processors and transfer stations separate mixed loads, focus on materials such as
 - Metal
 - Wood
 - Rigid plastics
- Problem materials
 - Bulky waste (mattresses, couches)
 - Electronics
 - Gypsum wallboard and ceiling tiles





Recycling – Source Separation



- Consider collecting separately to increase overall recycling rate
 - Gypsum wallboard
 - Ceiling tiles
 - Asphalt shingles
 - Asphalt pavement, brick & concrete
 - Carpet & carpet padding
 - Vinyl composite tile (VCT)
 - Cardboard
 - Expanded polystyrene packaging
 - Plastic film
 - Bulky waste (mattresses, furniture)
- Some materials difficult to separate or get damaged in mixed stream
- LEED v4 standards
 - Requires targeting 4 material streams
 - Mixed C&D counts as one stream





Resources



- General Reuse Information
- Nonprofit Reuse Outlets
- Material Brokers
- Architectural Salvage
- Wood Salvage
- Deconstruction Contractors





Next Steps



- **March:**
 - Post BMPs to RecyclingWorks website. Will consider “live document” that can be updated over time.
- **Later in 2017:** Collaborate with associations to share BMPs through presentation, newsletters, and social media

Contact RecyclingWorks with questions or comments:

info@RecyclingWorksMA.com or (888) 254-5525

www.RecyclingWorksMA.com

Ted Siegler and Natalie Starr, DSM Environmental Services

2016 C&D DEBRIS MARKET STUDY



2016 Construction and Demolition Debris Market Study



Report to MassDEP by:
DSM Environmental Services, Inc.

Project Goal

- ▶ MassDEP has a 50% diversion goal for C&D materials, but the rate has plateaued at around 30%.
- ▶ DSM was contracted to assess opportunities and constraints to increasing diversion beyond 30 percent.
- ▶ DSM could not have completed this study without participation and assistance from the seven facilities who willingly participated in our interviews, on-site surveys, and information requests.



Scope of Work



- ▶ Conducted site visits at five processors and two transfer stations
 - Interviewed owners/operators
 - Conducted surveys of incoming and outgoing materials
- ▶ Analyzed material flow from 2015 reports and DSM's understanding of C&D material/waste handling through field work and research
- ▶ Reviewed new technologies that might increase recovery of C&D materials from processing facilities
- ▶ Reviewed current market specifications and demand
- ▶ Identified barriers to increased materials diversion

Material Flow Analysis

- ▶ Processors and transfer stations receive different C&D material streams and perform the following:
 - Some materials are processed directly
 - Some are transferred to another in-state or out of state processing facility
 - Some are transferred directly, or indirectly (through another C&D transfer station) for disposal
- ▶ DSM tracked material flow to eliminate double counting (using 2015 facility reports)
 - Removed material delivered to one facility, but transferred (before or after processing) to a second, and reported in both totals
 - Disaggregated material delivered and reported as bulky waste, to calculate processing of C&D materials only.
- ▶ Calculated a revised C&D recycling rate based on these revisions



Recycling Rate

- ▶ Roughly 25 percent of *mixed C&D processed in-state* (219,000 of 865,000 tons) was recovered for recycling in Massachusetts.
 - Adding source separated materials delivered to processors (86,000 tons), 27% recycling rate for All C&D (in-state and out-of-state)
 - 32 percent if only C&D managed in-state is counted
- ▶ Diversion rate greater as landfill dependent uses total another 324,000 tons, or 31% of C&D waste processed in-state, or 23 percent of all C&D waste.
- ▶ Both exclude any out of state processing generating recyclables



Material Flow and Recycling Rates

Generation & Recovery	Reported 2015 Tons	Description	From Total Generation	From Net C&D	From Net Instate C&D
Generation	1,379,994	Throughput to in-state facilities includes double-counting	100%		
Less Bulky Waste	250,133	Coded as incoming bulky waste	18%		
Net C&D:	1,129,861	Generation minus bulky	82%		
Source Separated Materials	85,997	Incoming separated recyclable materials	6%		
Mixed C&D	1,043,864	Net Mixed C&D	76%	100%	
Transferred OOS	178,955	Coded as transferred out of state for processing	13%	17%	
Net In-State C&D:	864,909	Net Mixed In-State C&D to process	63%	83%	100%
Recovered	219,009	Recovered from mixed in-state C&D	16%	21%	25%
Landfill Dependent Uses	323,687	Total landfill dependent uses from Instate C&D	23%	31%	37%
Disposed	322,213	Net disposed from Instate Mixed C&D	23%	31%	37%
Recycling Rate					
Net C&D (from above)	1,129,861	Generation minus bulky	100%		
Transferred OOS	178,955	Coded as transferred out of state for processing	16%		
Net In-State Managed:	950,906	Includes source separated materials	84%	100%	
Recycling Rate	305,006	Recovered from processing, plus source separate material	27%	32%	
Landfill Dependent Uses	323,687	Total landfill dependent uses reported from instate C&D	29%	34%	
Disposed	322,213	Net disposed from Instate Mixed C&D Only	29%	34%	

Analysis of C&D Waste Processed in Massachusetts

- ▶ Conducted visual analyses of incoming loads of C&D at seven facilities, and outgoing loads of residues (from processors only) with the goal of characterizing the incoming material and outgoing residue
- ▶ Visual sample data compiled and converted to weight based estimates of the composition of incoming C&D materials and out-going residues by facility
- ▶ Grouped data by facility type to maintain confidentiality



Incoming C&D and Outgoing Residuals Composition Methodology

- ▶ Enumerator characterizes into eight primary and 44 secondary material categories.
 - Primary categories – Paper, Plastic, Glass, Organic (including carpet), C&D, Metals, Special (DTM) Wastes, Mixed MSW
 - C&D subcategories include ABC, Asphalt Roofing, Clean Lumber, Plywood, Treated Wood, Etc.
- ▶ First observes and briefly interviews incoming truck/driver to record hauler name, vehicle number, and volume of material delivered
- ▶ Then walks around tipped load and records (by volume) percent of each primary category, and then the percent of all secondary categories within each primary category
- ▶ Data entered into spreadsheet with volumes converted to pounds/tons based on each material's density.
- ▶ Total weight compared with weigh slip for load and adjusted (sum from visual estimate roughly equivalent to net weight of the load)
- ▶ Residual approach similar but samples were randomly taken from residue piles within the facility



Limitations

- ▶ Total weights summed for each facility, and a single average percent composition calculated for that day of observations for the incoming loads, and separately for the outgoing residue.
- ▶ Just one day at each facility, with goal of being representative of the year
- ▶ Visual analysis is not as accurate as weight based composition analysis
- ▶ Snow, ice and moisture can skew weight data, as can stored vehicle tare weights



Results, by Weight

INCOMING MATERIAL COMPOSITION	
	Average
Material Category	(%)
PAPER	2%
PLASTIC	2%
GLASS	2%
ORGANICS	2%
C&D	79%
METAL	5%
SPECIAL WASTE	5%
MSW (Bagged)	2%



Results and Average Composition of *C&D Materials*, By Weight

C&D	79%
Concrete/Brick/Rock	2%
Asphalt Paving	0%
Asphalt Roofing	11%
Wood Roofing	1%
Ceiling Tiles	2%
Vinyl Siding	0%
Pallets and Crates	4%
Clean Lumber	12%
Plywood	6%
Other Engineered Wood	6%
Wood Furniture	1%
Painted/Stained Wood	10%
Treated Wood	1%
Clean Gypsum Board	3%
Printed/Papered Gypsum Board	5%
Dirt, Sand and Gravel	5%
Fiberglass Insulation	0%
R/C and Other C&D	11%

*Wood is an
estimated 39%
of Incoming
C&D*



Estimated Recovery Rates

- ▶ Composition data for the seven participating facilities converted to annual tons by Material Type based on reported C&D waste received at that facility
 - Section 1: C&D Materials Accepted minus C&D transferred, and C&D received source separated
- ▶ Materials recycled or used divided by total material accepted
 - Section 2: C&D Materials Recycled or Used by Material Type



Estimated Recovery Rates, for Mixed C&D Waste *(Exclusive of Bulky)*

Sorted Material	Processors (%)	Transfer Stations (%)	Overall (%)
OCC	31%	9%	22%
Plastic	6%	0%	3%
Metal	100%	49%	90%
Asphalt/Brick/Concrete	100%	100%	100%
Asphalt Roofing	12%	2%	7%
Clean Gypsum Board	9%	0%	4%
Wood	32%	4%	22%
<i>Overall Materials Recovery Rate (1):</i>	<i>48%</i>	<i>6%</i>	<i>33%</i>

- 1) Material composition (% by facility) times C&D waste (total tons by material type) is compared against same material reported as recycled.
- 2) Excludes recycled materials reported separately as incoming materials.
- 3) Excludes electronics, glass, mattresses, tires and other misc. materials recovered in small quantities.

Takeaways

- ▶ Recovery rates for transfer stations are much lower than for processing facilities.
 - Different mix of incoming materials, and less or no manual and mechanical sorting equipment.
- ▶ Recovery rates for wood (largest single component of C&D waste) average 32 percent for processors, ranging from a low of 15 to a high of 43 percent.
 - Indicates that more wood could be recovered depending on sorting technologies and market demand



Analysis of Residue Composition

- ▶ Visual analysis same as for incoming composition
- ▶ Limitations:
 - Observed residue by taking grab samples off residue pile not from incoming loads
 - Limited samples necessarily results in relatively wide “confidence intervals” for the reported data
 - Heavy asphalt/brick/concrete and wood are removed during pre- and during processing which changes the relative volume (and weight) of remaining material.
 - Plastics (which are not as easily broken by excavators) and large pieces of corrugated are likely to be over represented in samples because they are much easier to identify than small pieces of broken wood or ABC



Residue Samples



Comparison, By Weight, of Incoming and Residue Composition

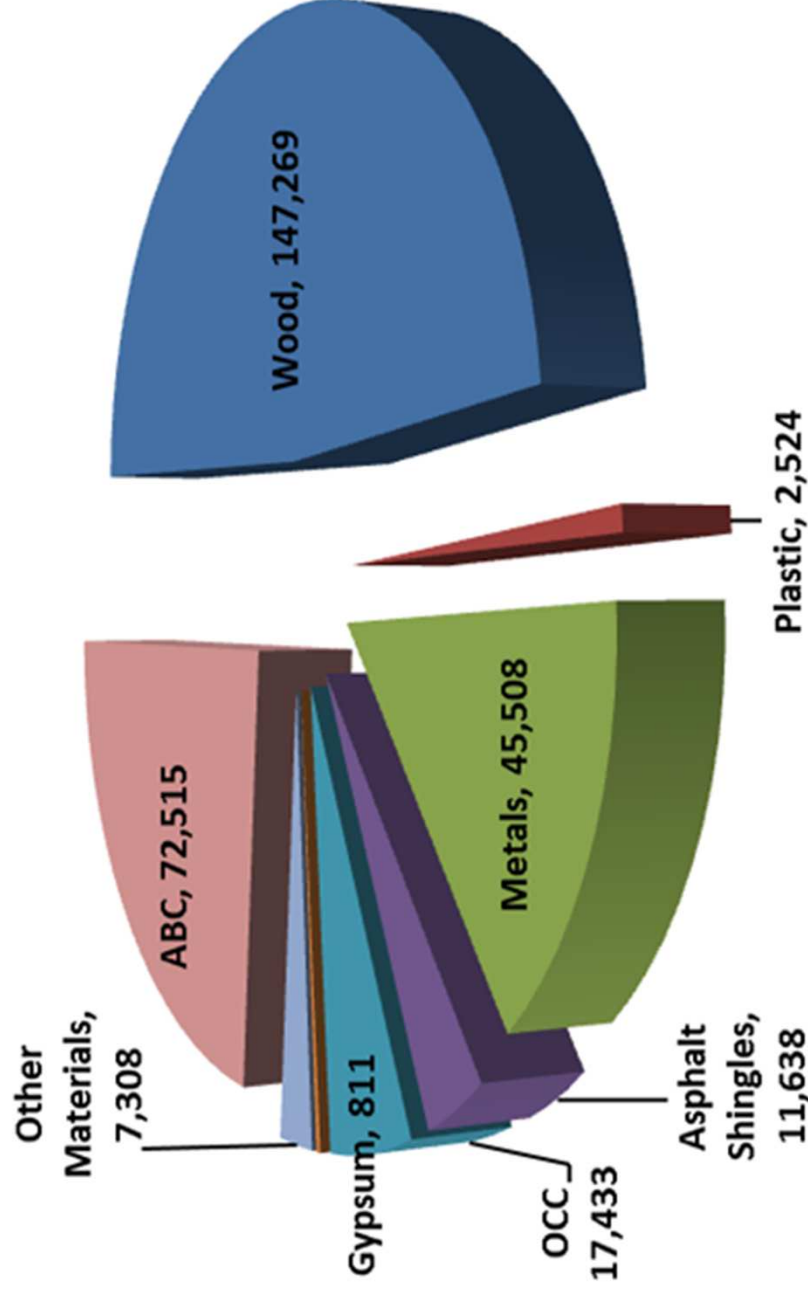
(Potentially Marketable Materials Only)

Material Category	INCOMING (%, By Weight)	Marketability	RESIDUALS (%, By Weight)
PAPER	2.3%		6.3%
OCC/Kraft	1.4%	H	3.3%
PLASTIC	2.5%		8.6%
Rigids	0.9%	M	4.5%
Film	0.1%	L	1.2%
ORGANICS	3.1%		3.9%
Yard Waste	1.3%	H	0.2%
Carpet/Padding	1.5%	L	3.7%
C&D	78.6%		74.5%
Concrete/Brick/Rock	2.1%	H	0.4%
Asphalt Roofing	11.3%	M	8.5%
"A Wood"	27.5%	H	22.3%
"B Wood"	10.6%	M	6.3%
Clean Gypsum Board	2.6%	L	3.0%
METAL	4.6%		2.5%
Ferrous	3.7%	H	1.2%
Non-Ferrous	1.2%	M	1.3%



Markets by Material Type

Composition of Material Sales, 2015



Waste Wood

- ▶ In 2007, there was a robust market for waste wood but today, markets have tightened up:
 - Sappi/Westbrook, Maine purchases very little waste wood from Massachusetts processors.
 - Boralex (ReEnergy) bio-fuels combustion facilities in Maine all stopped accepting waste wood (due to CT ruling concerning Renewable Energy Credits).
 - Quebec has tightened combustion specifications resulting in tighter specifications for burning waste wood :
 - Tafisa no longer has arrangement with Kruger so tightened its specification for fines (which they were sending to Kruger)
 - Allowable trace metals has been reduced at Tafisa, reducing the amount of fines Tafisa can accept in the “A” wood.



Waste Wood

- ▶ Tafisa is the largest single market for waste wood generate by Massachusetts C&D processors
- ▶ Tafisa consumed 216,000 tons in 2016, of which 60 percent were sourced from MA and NH
 - (e-mail correspondence from Sylvain Martel)
- ▶ They would like to increase consumption of waste wood, but fines remain a problem
- ▶ Plainfield Renewable Energy (PRE) gasification facility also purchases waste wood but they declined to provide information about the facility or quantities of waste wood purchased
 - DSM understands from processors that PRE has some operational and storage constraints and tighter specifications, especially for fines



Fines Markets, “Not Fine”

- ▶ As in 2007 fines continue to be a significant issue for C&D processors
 - Use of fines as ADC ended due to concerns with hydrogen sulfide emissions at landfills
 - Fines tend to have higher concentrations of trace metals and other contaminants so can't be mixed in with wood waste for delivery to bio-mass combustion facilities
 - Bio-mass combustion facilities accepting wood waste have reduced allowable fines
- ▶ Tafisa has also reduced the amount of allowable fines in their material, in part because the fines also contain higher concentrations of lead which Tafisa needs to limit in its' products.
- ▶ Result is that there are really no markets for fines, and fines are an inevitable by-product of processing mixed C&D waste:
 - Dumped on a tipping floor, breakage to size (prior to conveying to sort line) of incoming material by excavators, and grinding of resultant recovered wood, with screening to reduce fines, to meet end users specifications.



Old Faithful – OCC and Metals

- ▶ OCC market remains relatively stable
 - Most significant issue for processors is that OCC in mixed C&D loads often contaminated by other materials, and open top containers create wet OCC.
 - So while OCC picked for recycling, the recovery rate is much lower than in single stream MRFs, and the resultant value lower.
 - Most facilities do not have balers limiting markets
- ▶ Robust markets remain for both ferrous and non-ferrous metals, although with large swings
 - Metal in the residue is often attached to wood (such as roofing) or is wire and wire sheathing which can be difficult to manually remove, and may not be captured by magnets.

*Wishful Typical C&D
Load*



Plastics

- ▶ Plastic markets are relatively stable, but Chinese import restrictions have reduced the price of lower value plastics, the primary types available in mixed C&D.
- ▶ While bulky rigid plastics especially, including clean five gallon pails or other containers, have some value, contaminants significantly reduce their value.
- ▶ Plastic film is prevalent in mixed C&D but often relatively highly contaminated reducing its value.
 - And difficult to pull film off picking line as it gets tangled with other materials
- ▶ Rigid plastics found in the bulky waste deliveries (large plastic toys, outdoor play equipment, furniture, broken laundry, waste and recycling containers) are more likely to be recovered at facilities that market other MSW recyclables
 - They have easier access to plastic recycling markets and can mix and bale rigid C&D plastics with other residential/commercial plastics.



Still Waiting on Gypsum Markets

- ▶ While a gypsum recycling facility is supposed to open shortly in Raynham, DSM has been unable to confirm its' capacity and specifications.
- ▶ Gypsum recycled from MA facilities typically goes to Pennsylvania where it is made into an agricultural product.
- ▶ Best method for recycling gypsum is to manage it separately at the job site – when a component of mixed C&D, it tends to break into small particles during collection, transport and mixing on the tipping floor.
 - Gypsum is pulled off the tip floor manually from mixed loads
- ▶ Most gypsum recycling facilities require new gypsum, not painted or wallpapered gypsum, which is typical of demolition debris.



Asphalt Shingles

- ▶ Most asphalt roofing recycled is delivered directly to facilities/end markets
 - A fair amount of mixed C&D from roofing jobs or repairs contain asphalt shingles.
 - Main market in Massachusetts is Carneys (Raynham).
 - Other markets are Rooftop Recycling in Boxborough, MA and RAS-Tech located in Brentwood, NH.
- ▶ This material is not included in the C&D Recycling Rate



Processing Advancements and Target Materials

- ▶ Wood (dominant material with market value) can be recovered at relatively high rates depending on incoming loads and equipment available:
 - Recovery depends on ease of separation from contaminants such as pressure treated wood and difficulty of meeting Tafisa's specification
 - One solution may be to install additional equipment to recover this wood as "A" Wood for sale to Tafisa or to a bio-mass combustion facility.
 - MassDEP could assist with the capital cost of up-front conveyors, air separators, disc screens and optical sorters to recover more wood.
 - While optical identification of pressure treated wood is still in the development stage, it appears feasible according to several optical sort manufacturers
 - Lower cost approach might be to install more air separators and disc screens to remove contaminants from "B" wood lines



Alternative Uses of Waste Wood

- ▶ Small scale gasification units to convert the “B” Wood into energy are not feasible for MA C&D facilities primarily because processors need electric power (to run equipment) and not heat (for a building).
 - Any bio-gas produced would need an internal combustion engine to convert to electricity
 - Resulting bio-gas contains tars and other impurities that are difficult to fuel a combustion engine without (extensive) clean-up, which puts the cost significantly higher than buying conventional gasoline or diesel fuel
 - (Source Ted Pytler, Engineer).
- ▶ Metals have high value and while ferrous metals are removed by magnets, non-ferrous metals are found in the residue that might be valuable.
 - While additional metal recovery won't have much of an impact on the recycling rate, it could improve processing economics
 - Recovery of non-ferrous metals in most cases would involve the addition of eddy current separators with some additional clean-up of the material before separation



Other Materials

- ▶ If bulky, rigid plastic represent roughly 9 percent (by weight) of outgoing residue from processing and 80 percent might be bulky rigid plastic, there may be value in creating a separate bunker to collect this material.
 - If a facility accepts a lot of bulky waste, separation of bulky rigid plastics may be feasible
 - But without a baler, the net value to the processor is relatively low and therefore without the extra space, it may be uneconomical.
- ▶ Carpet had value in the past but the move away from nylon based carpet to PET based carpets has significantly reduced the value of dirty carpet.
 - DSM is not convinced investing in carpet recovery makes financial sense.
- ▶ There are markets (although limited) for asphalt shingles and gypsum
 - MassDEP should work with these markets to help ensure their success.
 - Both materials are better marketed when source separated at the job site.



Potential Recovery Rate and Recycling Rate

Recyclable Material	Amount In		Delivered		Total Available (tons) (3)	Total Recycled (tons) (4)	Current Recovery Rate (%) (5)	Potentially Achievable	
	Mixed C&D (tons) (1)	Source Separated (tons) (2)	Source Separated (tons) (2)	Recovery Rate (%) (6)				Potentially Achievable (tons) (7)	
Wood	318,372	21,377	339,749	147,269	43%	70%	237,824		
ABC	18,022	35,807	53,829	72,515	135%	100%	53,829		
Metals	39,721	3,137	42,858	45,508	106%	95%	40,715		
Gypsum	22,859	61	22,920	811	4%	10%	2,292		
Asphalt Shingles	97,760	8,909	106,669	11,638	11%	50%	53,335		
Cardboard	12,003	0	12,003	8,717	73%	70%	8,402		
Plastics	15,774		15,774	2,524	16%	50%	7,887		
Other Recyclable Materials (1)	NA	16,706	NA	16,706	NA	NA	30,000		
Total Material	524,512	85,997	610,509	305,687	50%		434,284		
Percent of In-State Managed C&D	55%	9%	64%						
Recycling Rate:				32%	46%				



Barriers to Reaching this Goal

- ▶ Market specifications for waste wood
- ▶ Relatively low cost landfill and rail transfer and disposal of waste wood
- ▶ Lack of a uniform definition of “processing” for C&D waste leading to low recovery rates at facilities without mechanized processing equipment
- ▶ Distance between where the majority of C&D is generated and availability of processing capacity
- ▶ Low value for commodities
 - The additional processing and transport costs outweigh the value even when a market can be found



Conclusions

- ▶ It is DSM's opinion that processors in Massachusetts are doing a relatively good job of recovering materials from mixed C&D waste – currently recovering roughly 50 percent of marketable materials, resulting in a 32 percent recycling rate for C&D waste managed in Massachusetts
 - Despite the fact that the market for wood waste is more limited now than in 2007
- ▶ Recovering greater amounts of material will require continued investment in new processing equipment at existing processing facilities and at transfer stations
 - Low tip fees make it difficult for processors to justify running low value C&D through their processing lines and constrains investment in new, capital intensive processing technologies

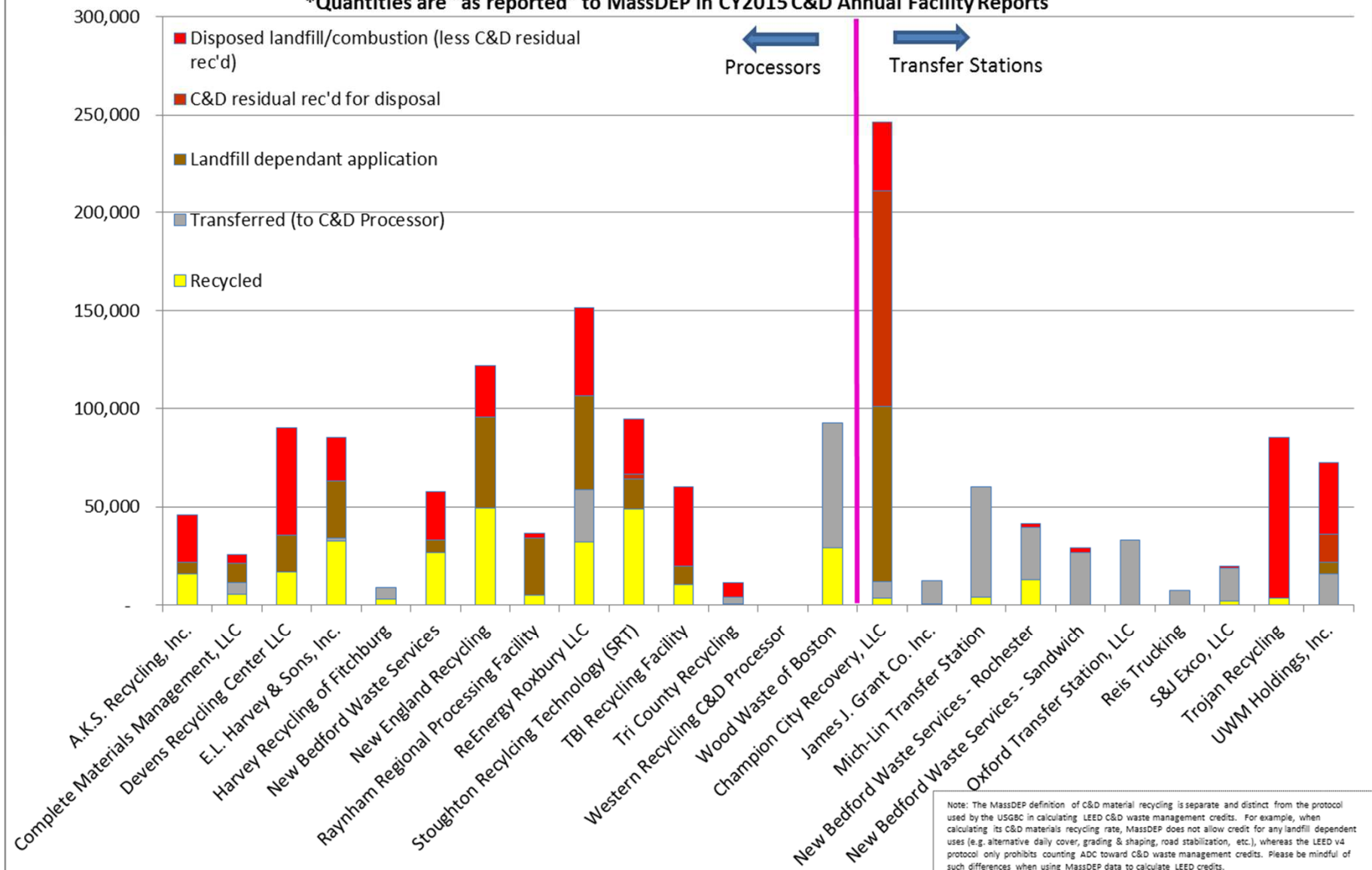


CY2015 C&D FACILITY ANNUAL REPORT DATA SUMMARY

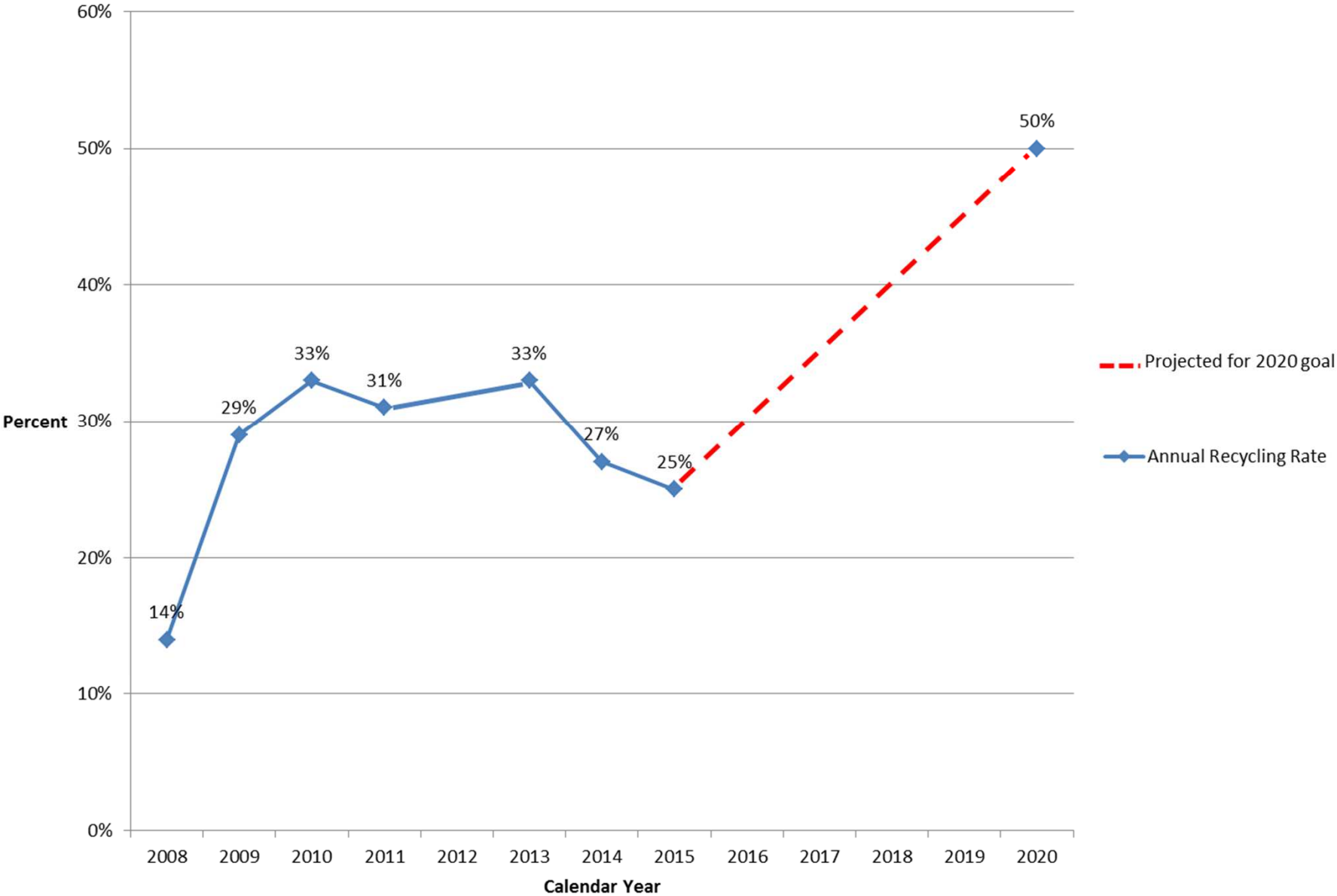
Massachusetts C&D Handling Facilities

Tons of C&D Accepted and Handled by Facility in 2015*

*Quantities are "as reported" to MassDEP in CY2015 C&D Annual Facility Reports



C&D Annual Recycling Rate Trend Chart



ANNOUNCEMENTS/OPEN DISCUSSION

Announcements from CDRA

by William Turley (Exec. Director of CDRA)

- LEED Recycling Credits
- Updated C&D White Paper
- Role of C&D Biomass in Zero Waste Programs

Closing/Next Steps

- Next MassDEP C&D Subcommittee Meeting
Ca. June 2017
- **Thank-you for your participation!**

For More Information:

Point of Contact:

Mike Elliott

Asbestos/C&D Program Coordinator

MassDEP – Bureau of Air & Waste

One Winter Street

Boston, MA 02108

michael.elliott@state.ma.us

617-292-5575